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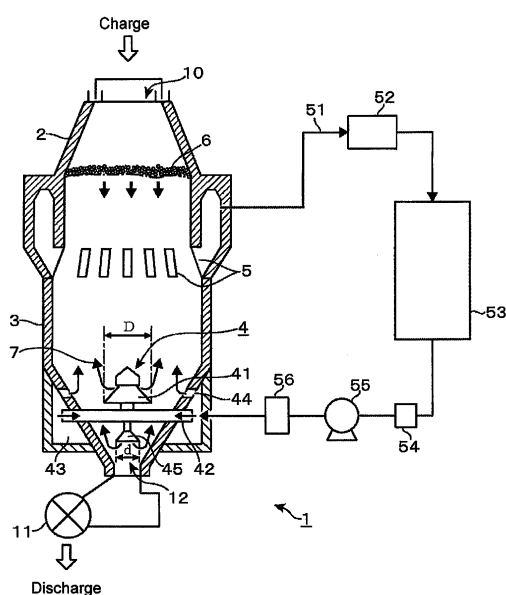
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(54) **COKE DRY TYPE EXTINGUISHING FACILITY, AND COKE DRY TYPE EXTINGUISHING METHOD**

(57) Coke dry quenching equipment with a blast head that can make the descent of coke uniform in a chamber to contribute to the improvement of the efficiency of cooling the coke is provided. There is also provided a coke dry quenching method. In the coke dry quenching equipment (1), red-hot coke is charged from the upper portion of a chamber (3) formed to have a lower conical portion, descends inside the chamber while being cooled by a cooling gas injected from a cooling gas supply unit disposed at the lower portion of the chamber, and is then discharged from a coke discharge port (12) disposed in the lower portion of the chamber. In this configuration, at least one small head (45) is disposed below a main head (4) disposed in the lower portion of the chamber, with the small head (45) having a diameter d smaller than the diameter D of the main head (41).

FIG.1



Description

TECHNICAL FIELD

[0001] The present invention relates to coke dry quenching equipment for cooling red-hot coke and to a coke dry quenching method.

Background Art

[0002] Coke dry quenching (CDQ) equipment installed in ironworks and the like is equipment for quenching red-hot coke dry-distilled in a coke oven using a cooling gas such as an inert gas. The high temperature coke is gradually cooled to improve its quality, so that the operation of an ironmaking blast furnace is stabilized. Coke dry quenching equipment is characterized in that the cooling gas is circulated in the system to allow coke dust to be prevented from flying out and that the sensible heat of the coke is recovered by a heat recovery apparatus such as a waste heat boiler to save energy.

[0003] As shown in Fig. 6, conventional coke dry quenching equipment 1 has a chamber in which a pre-chamber 2 having a coke charging port 10 formed at its upper portion is vertically connected to a cooling chamber 3 including a coke discharge unit 11 disposed at its lower portion.

[0004] The cooling chamber 3 is formed to have a conical lower part (for example, an inverted conical or inverted truncated conical lower part). A blast head 4 serving as a cooling gas supplying unit for injecting a cooling gas such as an inert gas to make the descending flow of coke uniform is disposed at the center of the conical part. The blast head 4 includes a substantially conical cap member 41 and is configured such that the cooling gas is circumferentially injected from an injection port (not shown) formed in the cap member 41. The blast head 4 is supported by a supporting member 42 having a gas flow passage formed therein, and the gas flow passage inside the supporting member 42 is in communication with a gas supply chamber 43. A part of the cooling gas supplied to the gas supply chamber 43 is configured to be supplied to the cooling chamber 3 also from cooling gas supplying units (for example, supply ports 44) disposed circumferentially in an inclined portion of the cooling chamber 3 that is located in the lower part thereof.

[0005] Moreover, a plurality of divided small flues 5 for discharging the cooling gas injected into the cooling chamber 3 are formed so as to circumferentially surround the barrel portion of the pre-chamber 2.

[0006] In the above configuration, high temperature red-hot coke 6 is charged into the chamber through the coke charging port 10 and continuously discharged from the bottom of the chamber through the coke discharge unit 11. During this process, the coke 6 descending inside the chamber is cooled by heat exchange with the cooling gas from the lower portion of the chamber that includes the blast head 4. The cooling gas increased in tempera-

ture by heat exchange is discharged from the chamber through the small flues 5. Although not shown in the drawing, the discharged gas passes through a dust removing unit is then supplied to a heat recovery apparatus such as a waste gas boiler to recover the heat, and is again supplied as the cooling gas to the chamber.

[0007] In the above coke dry quenching equipment 1, not all the coke 6 in the chamber uniformly descends straight down. The coke 6 inside the chamber gradually descends along different paths in different directions due to the influence of the shape and wall surface of the chamber and differences in properties of the coke. The non-uniform descent causes varied heat exchange of the coke 6, resulting in low cooling efficiency of the chamber as a whole, which has been a problem for a long time. Another problem is that a large chamber is required to cool the coke 6 to a predetermined temperature because the cooling efficiency of the chamber as a whole is low.

[0008] One known method to solve the above problems is to improve the blast head 4 (see, for example, Patent Documents 1 and 2). Patent Document 1 describes a method in which the skirt portion at the end of the blast head is driven to extend and contract, so that the width of the passage of coke is changed to control variation in heat exchange. Patent Document 2 describes a method in which the entire head portion of the blast head is vertically raised and lowered.

[0009] The blast head 4 disposed in the lower part of the chamber receives a high pressure from the charged coke 6 (such as the pressure caused by the mass of the coke and the descent thereof). Therefore, to raise and lower the blast head or to extend and contract the end of the blast head as described in Patent Documents 1 and 2, an expensive high-power driving unit is required. In addition, the temperature inside the chamber environment is high, and the chamber contains a large amount of dust. Therefore, the use of a movable blast head as in Patent Documents 1 and 2 can cause troubles in the equipment.

[0010]

[Patent Document 1 Japanese Patent Application Laid-Open No. Hei 1-110592

[Patent Document 2] Japanese Patent Application Laid-Open No. Sho 63-10691

DISCLOSURE OF THE INVENTION

PROBLEMS TO BE SOLVED BY THE INVENTION

[0011] The present invention has been made in view of the above circumstances. An object of the present invention is to provide coke dry quenching equipment including a blast head that can make the descent of coke uniform in a chamber to contribute to the improvement of the efficiency of cooling the coke and to provide a coke dry quenching method.

[0012] Another object of the present invention is to pro-

vide coke dry quenching equipment including a blast head that can improve the efficiency of cooling coke to reduce the size of the chamber and to provide a coke dry quenching method.

MEANS FOR SOLVING THE PROBLEMS

[0013] In coke dry quenching equipment of the present invention, red-hot coke is charged from an upper portion of a chamber formed to have a lower conical portion, descends inside the chamber while being cooled by a cooling gas injected from a cooling gas supply unit disposed in the lower portion of the chamber, and is then discharged from a coke discharge port disposed in the lower portion of the chamber. The coke dry quenching equipment is characterized by disposing at least one small head below a main head and having a diameter d smaller than a diameter D of the main head, wherein a blast head is disposed in the lower portion of the chamber and the diameter D of the main head is the diameter of the blast head.

[0014] Preferably, the small head is disposed such that an angle (θ_1) between a horizontal axis line and a line (T1) connecting an outer peripheral edge of the small head to the center of the coke discharge port is in the range of 60° to 80° . Preferably, the small head and the main head are disposed such that angles (θ_1 , θ_2) between a horizontal axis line and lines (T1, T2) connecting the outer peripheral edges of the small head and the main head to the center of the coke discharge port are in the range of 60° degrees to 80° . In this case, the angles θ_1 and θ_2 may be the same or different.

[0015] Preferably, an inclination angle θ_3 of the conical portion is in the range of θ_4 to $\theta_4 - 25^\circ$, where θ_4 is a smaller one of the angles (θ_1 , θ_2) between a horizontal axis line and lines (T1, T2) connecting outer peripheral edges of the small head and the main head to the center of the coke discharge port.

[0016] Preferably, a bore D_h of the coke discharge port is one-half or more of the diameter d of the small head ($D_h \geq 0.5d$).

[0017] Preferably, the small head is disposed at a position at which H is 1 to 5 times the bore D_h of the coke discharge port, where H is a distance from a repose angle lower plane of the coke that is formed below the small head to the coke discharge port.

[0018] Preferably, a gas flow passage for the cooling gas is provided in the main head or in each of the main head and the small head to constitute a cooling gas supply unit for injecting the cooling gas into the chamber.

[0019] A coke dry quenching method of the present invention includes charging red-hot coke from an upper portion of a chamber formed to have a lower conical portion, allowing the red-hot coke to descend inside the chamber and cooling the coke by a cooling gas injected from a cooling gas supply unit disposed in a lower portion of the chamber, and discharging the coke from a coke discharge port disposed in the lower portion of the cham-

ber. The method is characterized by disposing at least one small head below a main head and having a diameter d smaller than a diameter D of the main head, wherein a blast head is disposed in the lower portion of the chamber and the diameter D of the main head is a diameter of the blast head.

[0020] Preferably, the cooling gas is injected from the main head or from the main head and the small head to cool the red-hot coke.

EFFECTS OF THE INVENTION

[0021] According to the present invention, a small head is disposed below a main head and has a diameter d smaller than a diameter D of the main head, the blast head being disposed in the lower portion of the chamber and the diameter D of the main head is the diameter of the blast head. Therefore, the variation of the coke that descends inside the chamber is improved, and uniform descent of the coke is thereby achieved. This allows uniform heat exchange between the coke and the cooling gas in the chamber, and the efficiency of cooling the coke is thereby improved.

[0022] In the present invention, since uniform descent of the coke is achieved, the efficiency of cooling the coke is improved. Therefore, the size of the chamber can be reduced. In particular, since the cooling gas is injected also from the small head, a region below the blast head (main head), which is not utilized as a cooling zone in the conventional structure, can be used as a cooling zone. The cooling efficiency can thereby be further improved, and the size of the chamber can be further reduced.

BRIEF DESCRIPTION OF THE DRAWINGS

[0023]

Fig. 1 is a schematic diagram illustrating coke dry quenching equipment according to an embodiment of the present invention.

Fig. 2 is a horizontal cross sectional view of the coke dry quenching equipment.

Fig. 3 is a set of diagrams illustrating a blast head of the coke dry quenching equipment.

Fig. 4 is a diagram illustrating the action of the blast head.

Fig. 5 is a set of diagrams illustrating the effects of the blast head.

Fig. 6 is a schematic diagram illustrating conventional coke dry quenching equipment.

DESCRIPTION OF REFERENCE NUMERALS

[0024]

- 1 coke dry quenching equipment
- 2 pre-chamber

- 3 cooling chamber
- 4 blast head
- 41 main head
- 42 supporting member
- 45 small head

BEST MODE FOR CARRYING OUT THE INVENTION

[0025] Preferred embodiments of coke dry quenching equipment and a coke dry quenching method according to the present invention will be described in detail with reference to the drawings. However, the technical scope of the present invention is not construed as being limited to the description of the embodiments.

[0026] As shown in Figs. 1 and 2, a chamber of coke dry quenching equipment 1 in the present embodiment is configured to include a pre-chamber 2 having a coke charging port 10 in its upper portion and a cooling chamber 3 having a coke discharge port 12 in its bottom portion, the pre-chamber 2 and the cooling chamber 3 being connected vertically. These chambers can be formed of, for example, a refractory material such as steel or brick. High temperature coke 6 generated in a coke oven is charged into the pre-chamber 2 from the coke charging port 10 using a coke transferring unit (not shown) such as a bucket. The coke 6 charged into the pre-chamber 2 gradually descends and enters the cooling chamber 3. The coke 6 that enters the cooling chamber 3 continues descending gradually, is cooled by a cooling gas 7, and continuously discharged through a coke discharge unit 11 disposed at the coke discharge port 12. In general operation, the coke 6 is continuously discharged through the coke discharge unit 11 and is replenished on a batch basis. However, the present invention is not limited thereto.

[0027] The cooling chamber 3 is formed to have a cone-shaped (for example, inverted conical or inverted truncated conical) lower portion. A blast head 4 that is used as a cooling gas supply unit for injecting a cooling gas such as an inert gas and to make the descending flow of the coke 6 uniform is disposed in the central portion of the conical portion (for example, on the center axis thereof). As shown in Fig. 2, the blast head 4 is supported by a substantially cross-shaped supporting member 42 disposed so as to penetrate the side wall of the conical portion. In addition, a gas supply chamber 43 is formed so as to surround the outer circumference of the conical portion, and the ends of the supporting member 42 that penetrate the side wall of the conical portion extend inside the gas supply chamber 43. A gas flow passage (not shown) for the cooling gas is formed inside the supporting member 42. In this configuration, the cooling gas supplied to the gas supply chamber 43 is introduced into the blast head 4 through the gas flow passage and then injected into the chamber through the blast head 4. Part of the cooling gas supplied to the gas supply chamber 43 is supplied to the cooling chamber 3 also from cooling gas supply units (for example, supply ports 44) disposed

circumferentially in an inclined portion of the cooling chamber 3 that is located in the lower part thereof. However, the invention is not limited to this configuration. The cooling gas may be supplied from any one of the blast head 4 and a supply port 44. The substantially cross-shaped supporting member 42 shown in Fig. 2 is only an example. The shape of the supporting member 42 is not limited to the cross shape, so long as the supporting member 42 can support the blast head 4.

[0028] The blast head 4 of the present embodiment has a two-stage head structure having a main head 41 disposed in an upper section and a small head 45 disposed in a lower section. Each of the main head 41 and the small head 45 includes a substantially conical cap member and is configured such that the cooling gas is injected, for example, circumferentially from a gas injection port (not shown) formed in the cap member. The diameter (bore) d of the small head 45 is smaller than the diameter (bore) D of the main head 41. The shapes of the heads are not limited to the shapes shown in Fig. 1, so long as they satisfy the above condition. Preferably, as shown in Fig. 3(a), the small head 45 and the main head 41 are disposed such that the angles (θ_1 , θ_2) between a horizontal axis line and lines (T_1 , T_2) connecting the outer peripheral edges of the heads (in this example, the outer peripheral edges of the cap members) to the center of the coke discharge port 12 are in the range of 60° to 80° and particularly preferably 70° (condition (I)). "The coke discharge port" in the condition (I) is defined to mean the end of the inclined section of the conical portion (i.e., the lower end plane of the conical portion), as exemplified in Fig. 3(a). Preferably, both the angles (θ_1 , θ_2) are in the range of 60° to 80° . However, when at least the angle θ_1 of the small head 45 is in the above range, the angle θ_2 of the main head 41 may be outside the above range. Fig. 3(a) shows one exemplary arrangement in which the angles θ_1 and θ_2 are different. However, the heads may be arranged such that the angles θ_1 and θ_2 are the same.

[0029] More preferably, as shown in Fig. 3 (a), the inclination angle θ_3 of the conical portion is in the range of θ_4 to $\theta_4 - 25^\circ$ (condition (II)), where θ_4 is a smaller one of the angles (θ_1 , θ_2) between the horizontal axis line and the lines (T_1 , T_2) connecting the outer peripheral edges of the small head 45 and the main head 41 to the center of the coke discharge port 12.

[0030] More preferably, the bore D_h of the coke discharge port 12 shown in Fig. 3(a) is one-half or more of the diameter d of the small head 45 ($D_h \geq 0.5d$) (condition (III)).

[0031] Preferably, as shown in Fig. 3(b), the small head 45 is disposed at a position at which H is 1 to 5 times the bore D_h of the coke discharge port 12 and more preferably 1 to 3 times the bore D_h (condition (IV)), where H is the distance from the lower plane (h_1) of a space formed below the small head 45 at the angle of repose of the coke 6 to the coke discharge port 12. "The coke discharge port 12" in this condition is defined similarly to that in the

condition (I) above. Generally, the angle of repose of coke is 34° to 35° . Therefore, the height position of the lower plane (h_1) can be computed or arithmetically calculated using this value. However, the present invention is not limited thereto. The angle of repose may be computed using any other known method. For example, the angle of repose is measured using a sample of coke.

[0032] In the present embodiment, it is preferable that one of the conditions (I) and (IV) be satisfied. However, to achieve uniform descent of the coke in a more reliable manner, it is preferable that both the conditions (I) and (IV) be satisfied. More preferably, condition (I) is combined with condition (II) and/or condition (III).

[0033] Referring again to Fig. 1, a plurality of divided small flues 5 for discharging the cooling gas are formed so as to circumferentially surround the straight tubular barrel portion of the pre-chamber 2. A flue 51 is connected to the small flues 5. The flue 51 is connected to a heat recovery apparatus 53 such as a waste heat boiler through a dust catcher 52 used as a first dust removing unit. The gas cooled in the heat recovery apparatus 53 passes through a second dust removing unit 54, is sent to a pre-heater 56 by a blowing unit 55 such as a blower, and again supplied as the cooling gas to the cooling chamber 3. This configuration is well-known, and the detailed description thereof is omitted.

[0034] In the above coke dry quenching equipment 1, the coke 6 charged into the pre-chamber 2 from the coke charging port 10 gradually descends and enters the cooling chamber 3, while the coke 6 is continuously discharged from the bottom of the cooling chamber 3. The coke 6 is then cooled in the cooling chamber 3 by heat exchange with the cooling gas 7 injected from the main head 41 and the small head 45 and the cooling gas 7 injected from the supply ports 44 and is discharged through the coke discharge unit 11. Preferably, the ratio of the volume of gas per unit time from the main head 41 to that from the small head 45 is, for example, 8:2. As described in the section of BACKGROUND ART, the coke 6 descending inside the chamber generally tends to gradually descend along different paths in different directions due to the influence of the shape and wall surface of the chamber and differences in properties of the coke. The present inventors have thought that this is the main cause of the variation of the descent and have conducted extensive studies. The inventors have found that the addition of the small head 45 that is smaller than the main head 41 and is disposed below the main head 41 can significantly improve the nonuniformity of the descent. Thus the invention has been completed. Particularly, when the main head 41 and the small head 45 satisfy the above relational condition (I) and/or condition (IV), the above effect is high. Tests were actually performed to confirm that the values in the conditions (I) and (IV) are tightly related to the properties of coke.

[0035] The inventors consider that the reason that the variation of the descent can be improved is as follows. As schematically illustrated in Fig. 4, in the conical portion

of the cooling chamber 3, the direction of the flow of the coke 6 descending in the central portion of the chamber is changed to a circumferentially outward direction by the main head 41, so that the slow descending flow of the coke near the furnace wall is facilitated. Then a flow directed to the center at the angle of repose is formed below the main head 41. The direction of the flow is changed to the circumferentially outward direction by the small head 45, so that the flow of the coke near the furnace wall is further facilitated. Then a flow directed to the center at the angle of repose is formed below the small head 45, and the coke is discharged through the coke discharge port 12. The flow state is regulated in the conical portion in the manner described above. Therefore, after the coke in the central portion of the chamber passes over the main head 41, this coke is prevented from selectively descending toward the coke discharge port 12 and descends uniformly together with the coke near the wall. The variation of the descent in the cooling chamber 3 is thereby improved.

[0036] If the condition (I) described above is satisfied, the circumferentially outward flows formed by the main head 41 and the small head 45 can more effectively act on regions in which the internal friction angle of the coke causes low fluidity, and the variation of the descent can thereby be improved in a more reliable manner. More specifically, the inventors have focused attention on that the internal friction angle of coke is about 75° , and the angles of the outer peripheral edges of the main head 41 and the small head 45 are set to 60° to 80° . This allows the circumferentially outward flows to more effectively act on the regions in which the internal friction angle of the coke causes low fluidity. The operational effects of the condition (I) can be more effective when the condition (I) is combined with the condition (II) and/or the condition (III).

[0037] The condition (IV) described above allows the height position of the small head 45 to be more preferable. If the condition (IV) is satisfied, the variation of the descent can be improved in a more reliable manner. More specifically, as illustrated in Fig. 5, when the condition $D_h \leq \text{distance } H \leq 5D_h$ is satisfied, the nonuniformity of descent is smaller than that when the distance H is smaller than the bore D_h and that when the distance H is larger than 5 times the bore D_h . This may be because, when the distance H is larger than 5 times the bore D_h (Fig. 5 (b)), the distance from the small head 45 to the coke discharge port 12 is too long, so that the coke that passes over the small head 45 selectively descends through the central portion. When the distance H is smaller than the bore D_h (Fig. 5(a)), the distance from the small head 45 to the coke discharge port 12 is too short. Therefore, it is assumed that the coke may be discharged before the flow of coke is changed to a circumferentially outward direction below the small head 45 and the flow is formed into a flow toward the center at the angle of repose. In Fig. 5(a), the space between the small head 45 and the wall surface of the chamber through which the coke pass-

es becomes narrow, and this may be another cause.

[0038] As described above, in the present embodiment, the small head 45 smaller than the main head 41 in size is added to provide a two-stage head structure in which the small head 45 is disposed below the main head 41. The variation of the descent of the coke inside the conical portion of the chamber is thereby improved, whereby uniform descent of the coke is achieved over the entire chamber. When uniform descent of the coke is obtained inside the chamber, uniform heat exchange between the coke and the cooling gas is achieved in the chamber, and the efficiency of cooling the coke can thereby be improved. In particular, when the conditions (I) to (IV) are satisfied, such an effect can be enhanced.

[0039] In the present embodiment, since the efficiency of cooling the coke is improved, the size of the chamber can be reduced. In particular, by injecting the cooling gas also from the small head 45, the region below the main head 41, which is not utilized as a cooling zone in the conventional structure, can be used as a cooling zone. Therefore, the cooling efficiency can be further improved, and the size of the chamber can be further reduced. However, the cooling gas may not be injected from the small head 45, and the cooling gas may be injected only from the main head 41.

[0040] In the present invention, the number of small heads 45 disposed below the main head 41 is not necessarily limited to one, and a multi-stage head structure having 3 or more stages may be used. In such a case, it is preferable to reduce the headbore (d) gradually for lower heads.

[0041] Embodiments and examples of the present invention have been exemplified above. However, it is apparent for a person skilled in the art that various modifications and changes may be made without departing from the spirit and scope of the present invention and fall within the technological range of the present invention.

Claims

1. Coke dry quenching equipment wherein red-hot coke is charged from an upper portion of a chamber formed to have a lower conical portion, descends inside the chamber while being cooled by a cooling gas injected from a cooling gas supply unit disposed in the lower portion of the chamber, and is then discharged from a coke discharge port disposed in the lower portion of the chamber, the coke dry quenching equipment being **characterized by** placing a main head of a blast head having a diameter D on a supporting member disposed so as to penetrate a side wall of the conical portion in the lower portion of the chamber, and suspending at least one small head of the blast head having a diameter d smaller than the diameter D of the main head so as to be disposed below the main head.
2. The coke dry quenching equipment according to claim 1, wherein a longitudinally extending supporting member is disposed from the supporting member below the main head, and the small head is suspended from the longitudinally extending supporting member, so as to dispose and fix the small head below the main head.
3. The coke dry quenching equipment according to claim 2, wherein the longitudinally extending supporting member from the supporting member below the main head is disposed and extended along a central axis of the main head and the small head.
4. The coke dry quenching equipment according to claim 1, wherein the small head is disposed such that an angle (θ_1) between a horizontal axis line and a line (T1) connecting an outer peripheral edge of the small head to a center of the coke discharge port is in a range of 60° to 80° .
5. The coke dry quenching equipment according to claim 1, wherein the small head and the main head are disposed such that angles (θ_1 , θ_2) between a horizontal axis line and lines (T1, T2) connecting respective outer peripheral edges of the small head and the main head to the center of the coke discharge port are in a range of 60° degrees to 80° .
6. The coke dry quenching equipment according to any one of claims 1 to 5, wherein an inclination angle θ_3 of the conical portion is in a range of θ_4 to $\theta_4 - 25^\circ$, where θ_4 is a smaller one of angles (θ_1 , θ_2) between a horizontal axis line and lines (T1, T2) connecting outer peripheral edges of the small head and the main head to the center of the coke discharge port.
7. The coke dry quenching equipment according to any one of claims 1 to 6, wherein a bore Dh of the coke discharge port is one-half or more of the diameter d of the small head ($D_h \geq 0.5d$).
8. The coke dry quenching equipment according to any one of claims 1 to 7, wherein the small head is disposed at a position at which H is 1 to 5 times the bore Dh of the coke discharge port, where H is a distance from a repose angle lower plane of the coke that is formed below the small head to the coke discharge port.
9. The coke dry quenching equipment according to any one of claims 1 to 3, wherein the small head and the main head are disposed such that angles (θ_1 , θ_2) between a horizontal axis line and lines (T1, T2) connecting respective outer peripheral edges of the small head and the main head to the center of the coke discharge port are in a range of 60° degrees to 80° , and

the small head is disposed at a position at which H is 1 to 5 times the bore D_h of the coke discharge port, where H is a distance from a repose angle lower plane of the coke that is formed below the small head to the coke discharge port.

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10. The coke dry quenching equipment according to any one of claims 1 to 9, wherein a gas flow passage for injecting the cooling gas is provided in the main head or in each of the main head and the small head.
11. The coke dry quenching equipment according claim 10, wherein the gas flow passage to provide the cooling gas to small head is formed inside the longitudinally extending supporting member.
12. A coke dry quenching method comprising charging red-hot coke from an upper portion of a chamber formed to have a lower conical portion, allowing the red-hot coke to descend inside the chamber and cooling the coke by a cooling gas injected from a cooling gas supply unit disposed in a lower portion of the chamber, and discharging the coke from a coke discharge port disposed in the lower portion of the chamber,
the method being **characterized by** placing a main head of a blast head having a diameter D on a supporting member disposed so as to penetrate a side wall of the conical portion in the lower portion of the chamber, and suspending at least one small head of the blast head having a diameter d smaller than the diameter D of the main head so as to dispose below the main head, thereby regulating a flow of the coke that descends inside the chamber.
13. The coke dry quenching method according to claim 12, wherein the cooling gas is injected from the main head or from the main head and the small head via the supporting member to cool the red-hot coke.

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FIG.1

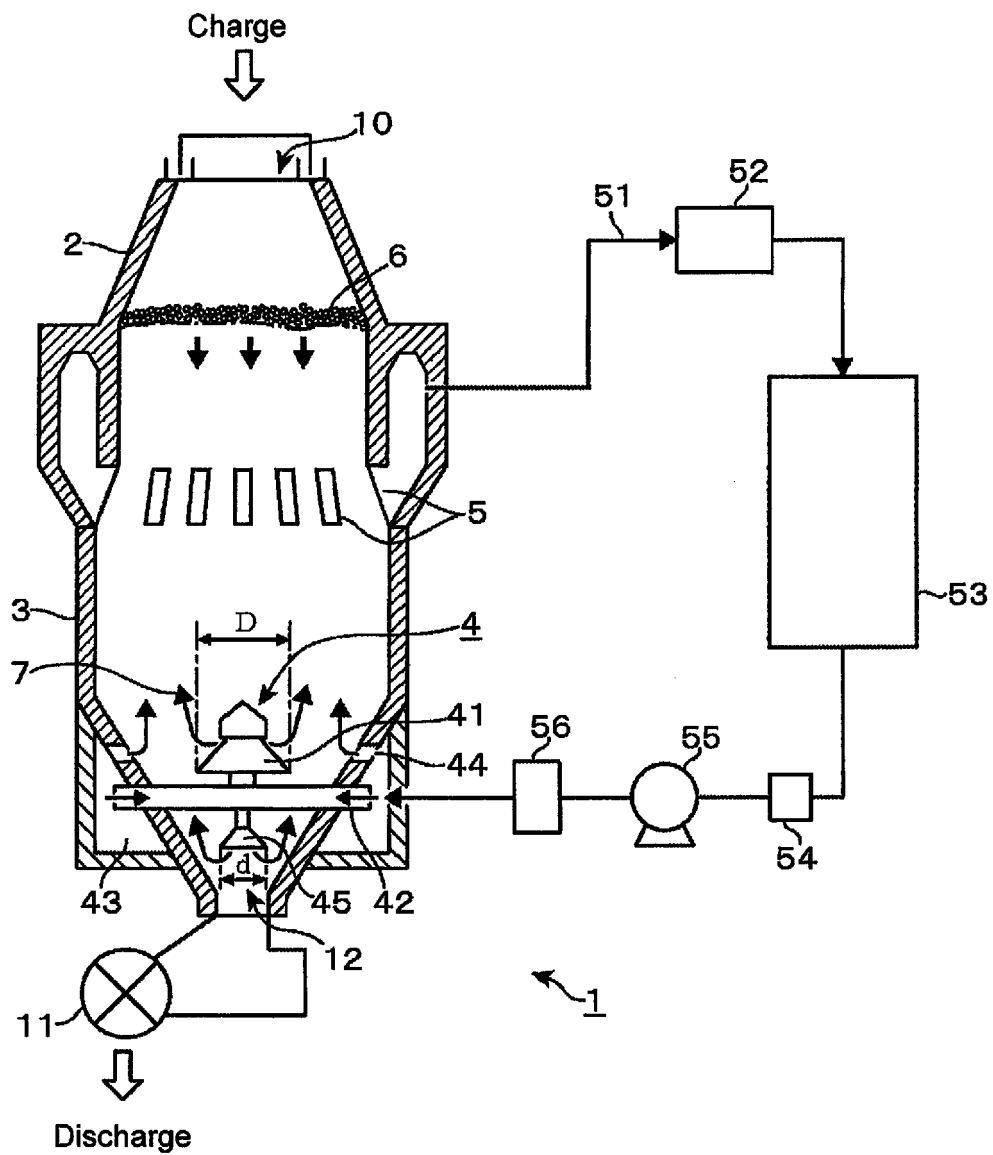


FIG.2

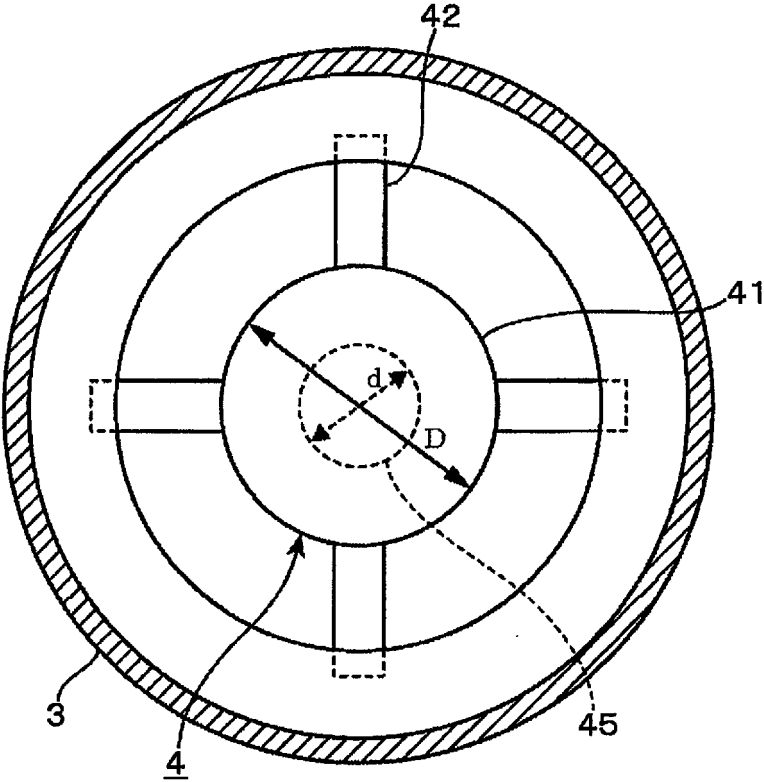
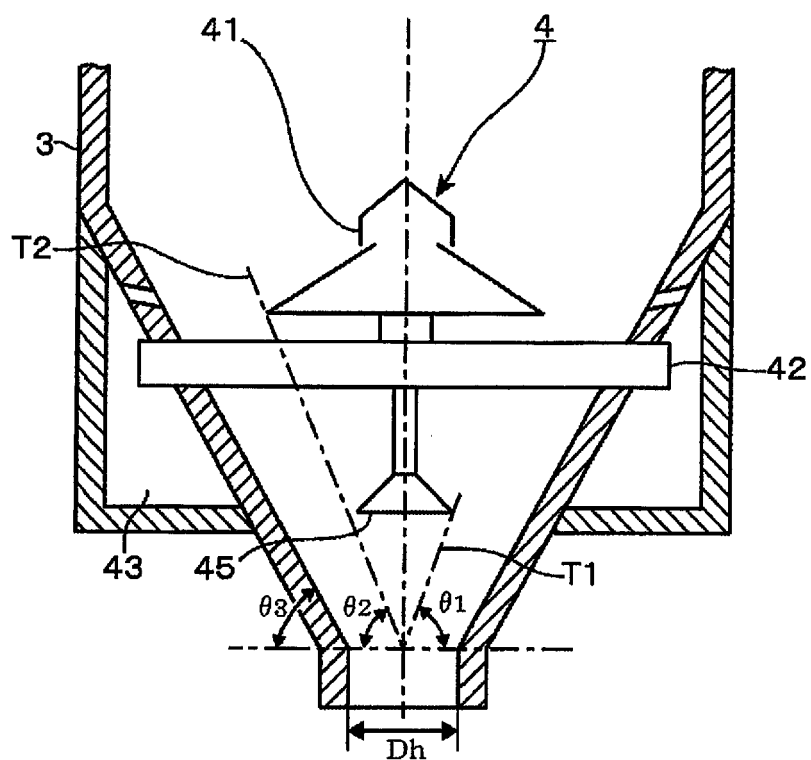


FIG.3

(a)



(b)

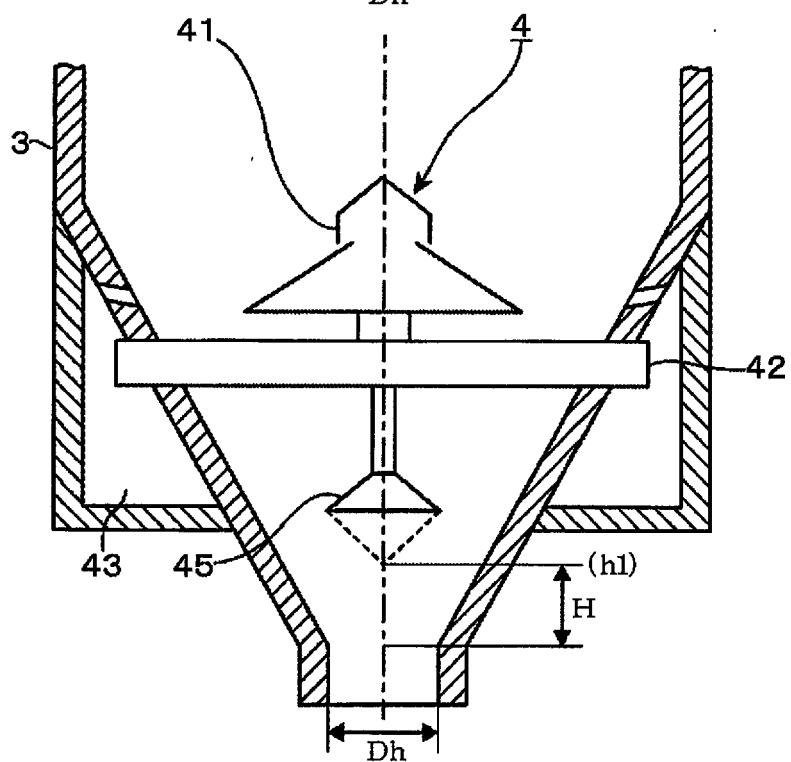


FIG.4

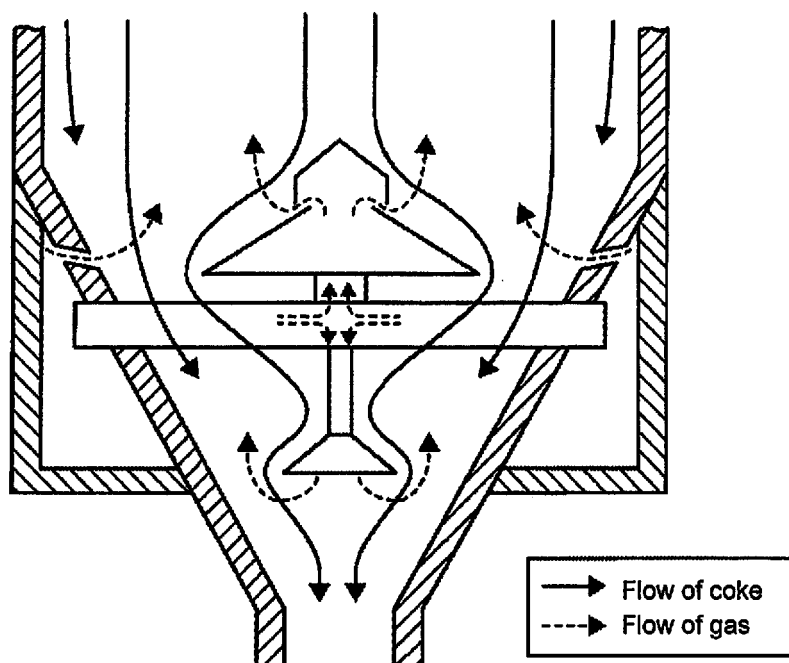


FIG.5

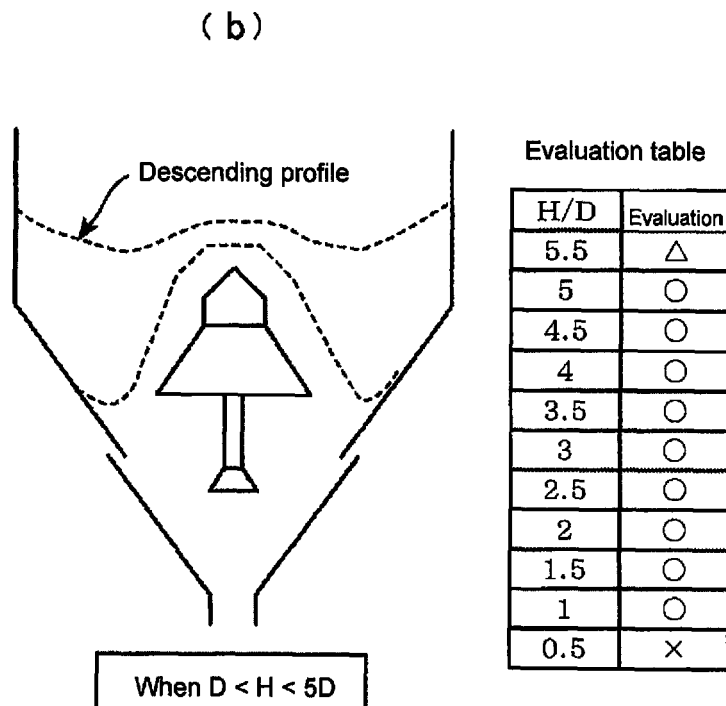
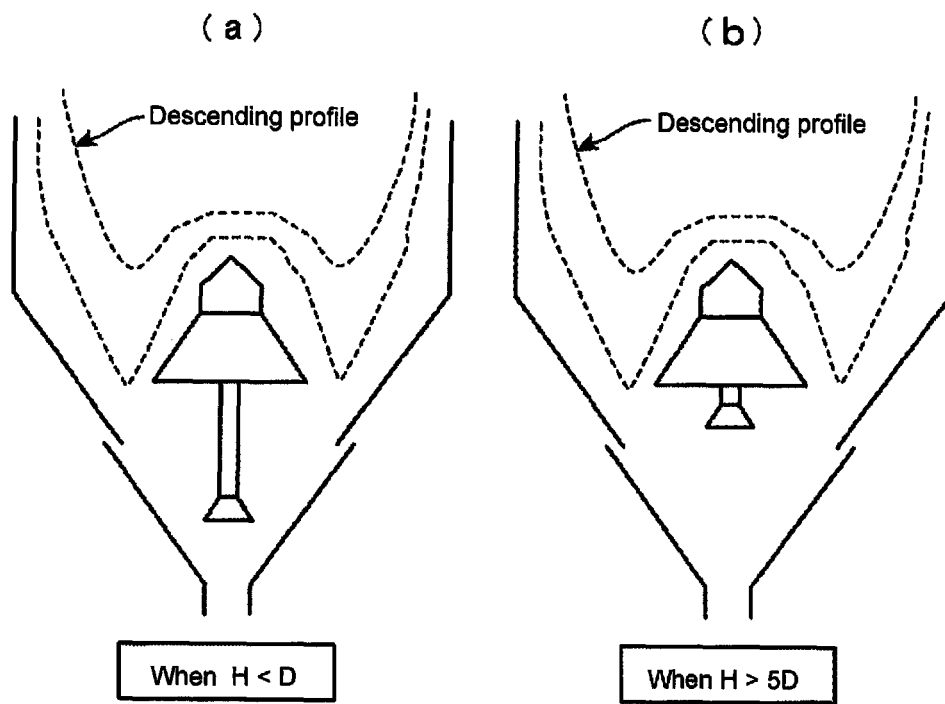
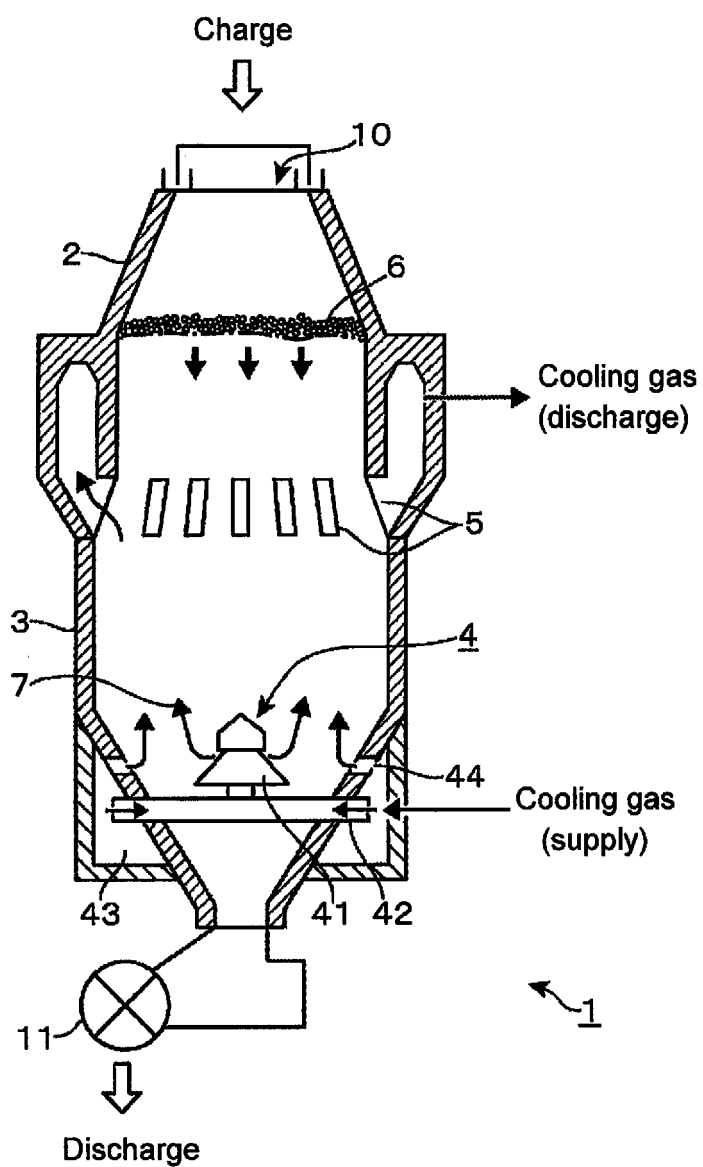


FIG.6



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2008/068583

A. CLASSIFICATION OF SUBJECT MATTER

C10B39/02 (2006.01) i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

C10B39/02

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2009

Kokai Jitsuyo Shinan Koho 1971-2009 Toroku Jitsuyo Shinan Koho 1994-2009

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 59-17883 Y2 (Hitachi Zosen Corp.), 24 May, 1984 (24.05.84), Claims; page 1, column 2, lines 13 to 37; Fig. 2 (Family: none)	1-9
A	US 1462119 A (A.MOETTELE), 17 July, 1923 (17.07.23), All references (Family: none)	1-9
A	US 4416733 A (E.P.Likhogub et al.), 22 November, 1983 (22.11.83), All references & JP 58-196289 A & GB 2119486 A & DE 3215807 A & FR 2527627 A & AU 8346382 A & CA 1196307 A	1-9

☐ Further documents are listed in the continuation of Box C.☐ See patent family annex.

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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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Date of the actual completion of the international search
07 January, 2009 (07.01.09)Date of mailing of the international search report
20 January, 2009 (20.01.09)Name and mailing address of the ISA/
Japanese Patent Office

Authorized officer

Facsimile No.

Telephone No.

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP HEI1110592 B [0010]
- JP SHO6310691 B [0010]